

A wide-angle photograph of a rural landscape. In the foreground, a green grassy field is separated from the background by a white fence with dark posts. The background shows a line of trees, including several palm trees, and a building partially visible on the right. The sky is blue with scattered white clouds.

TRAFFIC IMPACT ASSESSMENT

RESIDENTIAL SUBDIVISION

**LOT 1308 IN DP 1141533
213 STATION LANE, LOCHINVAR**

PREPARED FOR: BRADHIL Pty Ltd

AMENDED NOVEMBER 2021

20/129

**TRAFFIC IMPACT ASSESSMENT
BRADHIL PTY LTD**

**RESIDENTIALSUBDIVISION
LOT 1308 IN DP 1141533
213 STATION LANE, LOCHINVAR**

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QUALITY ASSURANCE

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This document has been authorised by


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1.0 INTRODUCTION

Intersect Traffic Pty Ltd (Intersect Traffic) has been engaged by Bradhil Pty Ltd to undertake a traffic impact assessment for a proposed residential subdivision of Lot 1308 in DP 1141533, 213 Station Lane, Lochinvar providing for 169 residential allotments to be constructed in 7 stages. The subject site is within the Lochinvar Urban Release Area and currently contains a single rural property containing one dwelling and rural sheds.

The new allotments will be accessed via Station Lane via two new intersection accesses approximately 460 metres and 660 metres north-east of the Station Lane rail overbridge. No further residential development will be possible south of the site however an access for rail maintenance operation is provided through the development. The subdivision is designed in accordance with the approved Lochinvar URA masterplan and structure plan such that it will allow for further subdivisions to the north and east of the site. From Station Lane traffic can head towards the New England Highway directly via Station Lane to the future restricted (left in and left out only) intersection of these two roads or connect to the recently completed New England Highway / Wyndella Road signalised intersection via extensions of Christopher Road (currently being upgraded) and Wyndella Road or other roads through the Mount Hereford residential estate also currently under construction. It is highly likely this connection will be available within the next 12 months before any release of land occurs in this subdivision.

The new subdivision roads will be constructed to Maitland City Council requirements in accordance with the current version of the Lochinvar Urban Structure Plan and supporting documents i.e. traffic study and will require widening of Station Lane. The proposed subdivision plan is shown in **Attachment A**. This report is required to support a development application to Maitland City Council as the consent authority for the subdivision. It will allow Council to assess the proposal regarding its impact on the local and state road network. This report presents the findings of the traffic assessment and includes the following.

1. An outline of the existing situation near the site.
2. An assessment of the traffic impacts of the proposed development including the predicted traffic generation and its impact on existing road and intersection capacities.
3. An assessment of the cumulative impacts of other known developments in the area.
4. Reviews parking, public transport, pedestrian, and cycle way requirements for the proposed development, including assessment against Council and Australian Standards.
5. Presentation of conclusions and recommendations.

2.0 SITE DESCRIPTION AND LOCATION

The subject site is located on the eastern side of Station Lane, Lochinvar. The centre of the 350 metre Station Lane frontage of the property is approximately 1.4 km south of Christopher Road and is also approximately 2 km south of the Lochinvar village shops. The site is currently a rural property with a single dwelling and several sheds erected on it. The southern boundary adjoins a rural residential property and the Hunter Rail Line, also known as the Great Northern Railway, whilst the northern and eastern boundaries adjoin similar rural land to that of the subject development. **Figure 1** shows the site and its location among the surrounding adjoining properties.

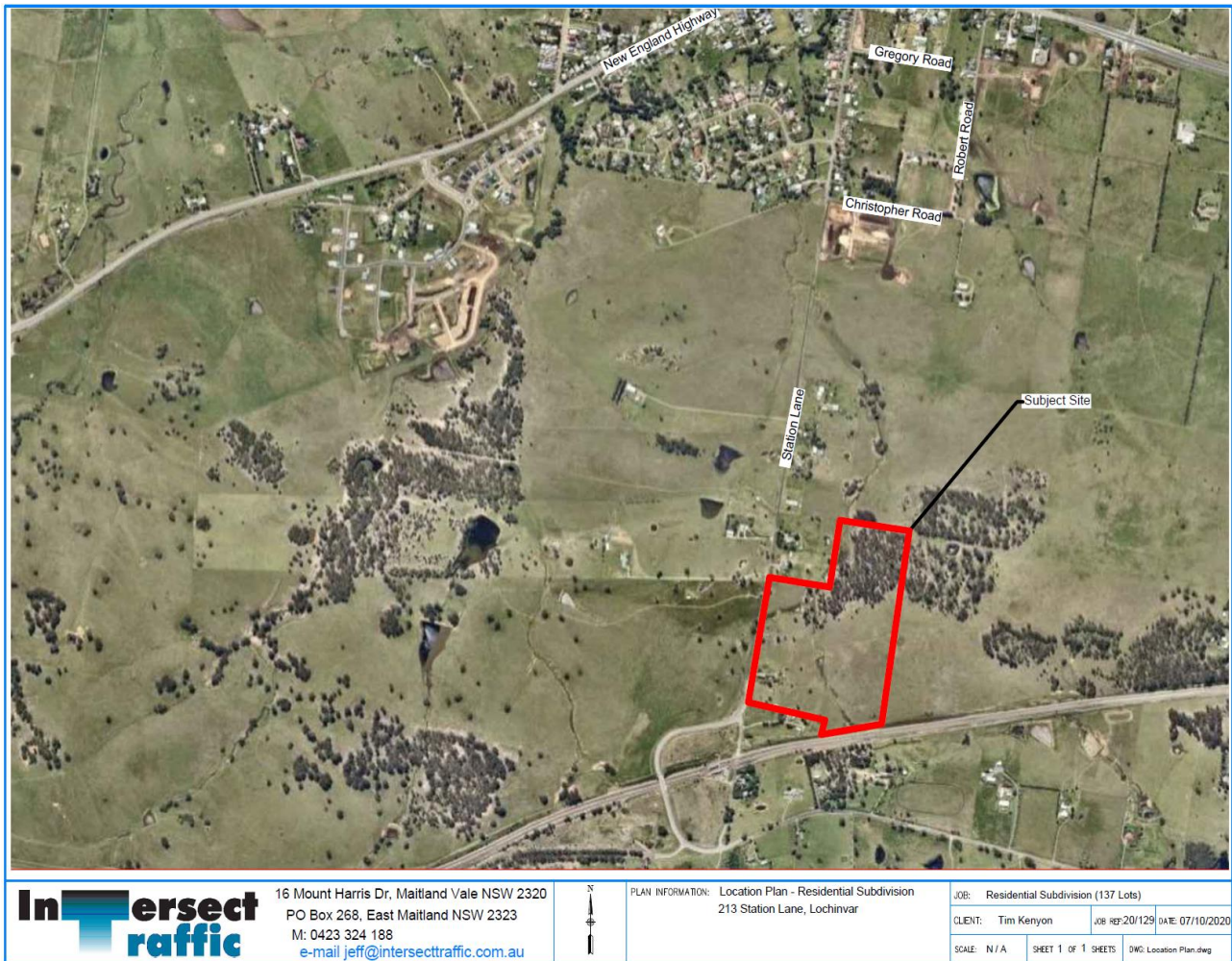


Figure 1 – Site Location

The site has the following property descriptors:

- ◆ Formal land title of Lot 1308 in DP 1141533,
- ◆ Postal address of 213 Station Lane, Lochinvar,
- ◆ Site area of approximately 20 hectares, and
- ◆ Land zoning of R1 General Residential and E3 Environmental Management pursuant to the Maitland LEP (2011).

The site currently has a rural unsealed combined entry / exit vehicular access via the western side of Station Lane. **Photographs 1 & 2** show some of the existing development on the site and the existing vehicular access at the site.



Photograph 1 – Development site



Photograph 2 – Existing Site Access – Station Lane

3.0 EXISTING ROAD NETWORK

3.1 New England Highway

The New England Highway is part of the classified state highway network (SH9) and is a major arterial road in the region. It is currently under the care and control of the NSW Roads and Maritime Services (RMS). With the opening of the Hunter Expressway it now performs the function of a sub-arterial road connecting Maitland to the rural areas of Lochinvar, Greta and Branxton. Generally, the New England Highway through Lochinvar is a two-lane two-way road with wide sealed shoulders. Lane widths are approximately 3.5 metres and wide sealed shoulders are provided. A 60 km/h speed limit applies to this section of road and at the time of inspection the New England Highway was observed to be in good condition (**Photograph 3**).



Photograph 3 – New England Highway near Station Lane

3.2 Station Lane

Station Lane is a local road under the care and control of Maitland City Council with its primary function providing access to properties along its length. Near the site, it is a two-lane two-way sealed rural road with grass verges / table drains. The total sealed carriageway width on Station Lane from the NEH to Christopher Road varies between approximately 9 to 11 metres wide. The Station Lane frontage of the site varies from approximately 6 metres sealed width to 9 metres where shoulders have been sealed and centreline and edge line markings are present. A 50 km/h speed limit applies to the road and at the time of inspection Station Lane was observed to be in fair to good condition. **Photograph 4** shows Station Lane with its various sealed width constructions towards the southern end of the property



Photograph 4 – Station Lane near the site

3.3 Christopher Road

Christopher Road near the site is a local road under the care and control of Maitland City Council with its primary function providing access to properties along its length. It is constructed only between Robert Road and Station Lane being unformed east of Robert Road. Near the site, it is a two-lane two-way sealed rural road with grass verges / table drains. The total sealed carriageway width is approximately 5 to 5.5 metres wide. A 50 km/h speed limit would apply to this section of road and at the time of inspection Christopher Road was observed to be in fair condition (**Photograph 5**). Christopher Road will be upgraded and widened as part of the Lochinvar Downs residential subdivision currently under construction.

3.4 New England Highway / Station Lane intersection

The New England Highway / Station Lane intersection is currently a give way controlled cross - intersection with Cantwell Road being the northern leg of the intersection. This intersection is constructed as a rural BAR/AUL (Basic Right Turn / Auxiliary Left Turn) standard on the Highway. Protected left turn deceleration lanes are provided at the intersection for left turning vehicles from the Highway into both Station Lane and Cantwell Road to facilitate the safe movement of turning traffic at the intersection (**Photograph 6**).

As part of the Lochinvar Downs subdivisional work the New England Highway / Station Lane will be upgraded with additional channelisation constructed to prohibit the right turn movement from Station Lane. A U-turn bay is also being constructed on the New England Highway west of the intersection to allow vehicles with a destination to the east of Station Lane to turn left out of Station Lane and then undertake a safe U-turn movement at the U-turn bay to travel east.



Photograph 5 – Christopher Road at Station Lane



Photograph 6 – New England Highway /Station Lane intersection

4.0 ROAD NETWORK IMPROVEMENTS

The major road network upgrade that occurred recently is the opening of the Hunter Expressway (M15). This motorway has been constructed to relieve traffic congestion through Branxton, Greta, Lochinvar and Maitland. Therefore, a significant decrease in traffic volumes has resulted on the New England Highway through Lochinvar which has increased the available spare capacity in the arterial / sub-arterial road network near the site.

The subject site is also within the Lochinvar Urban Release Area (LURA) and as part of the planning process a structure plan for the LURA was adopted in 2007. The structure plan includes an indicative road network layout which is likely to result in several road upgrades in the area. Of most relevance to this development will be:

- ◆ Provision of a major intersection (signalised) at the intersection of Wyndella Road and the New England Highway which has recently been constructed and the signals are now operational. Construction of the lead in roads will progressively occur with the development of the land along Christopher Road.
- ◆ New England Highway / Station Lane to be converted to a restricted movement (left in and left out only) with a U-turn bay to be provided near the business area west of the intersection. As mentioned above this will be partially undertaken with the Lochinvar Downs subdivisional works and will be fully completed once Springfield Drive is constructed through Lochinvar Downs and connected to the new southern leg of the New England Highway / Wyndella Road traffic signals, and
- ◆ Where lots have direct frontage to Station Lane and Christopher Road, **upgrading and localised road widening (including land resumption) will be required. These roads will be progressively upgraded as development occurs.**

5.0 TRAFFIC VOLUMES

Northern Transport Planning and Engineering on behalf of Intersect Traffic carried out manual traffic counts at the New England Highway / Station Lane intersection on Wednesday 14th July 2021 and Thursday 15th July 2021 during peak traffic periods. The peak hour periods were found to be from 8.00am to 9.00am and 3pm to 4pm.

These counts determined the following mid-block peak hour traffic volumes on the New England Highway and Station Lane at this location as shown in **Table 1** below. The table also provides estimates of 2031 traffic volumes on the local and state road network based on increasing the 2021 volumes using a background traffic growth rate of 3% per annum due to the escalation of development works in the Lochinvar URA, for a further 10 years.

Table 1 – 2021 and 2031 Traffic Volumes.

Road	Section	2021		2031 @ 3% p.a.	
		AM (vtpH)	PM (vtpH)	AM (vtpH)	PM (vtpH)
New England Highway	East of Station Lane	1258	1312	1691	1763
New England Highway	West of Station Lane	1266	1326	1701	1782
Station Lane	South of New England Highway	271	177	364	238

The tally sheets for the 2021 manual traffic counts are provided within **Attachment B**.

6.0 ROAD CAPACITY

The capacity of urban and rural roads is generally determined by the capacity of intersections. However, Table 4.3 of the RTA's *Guide to Traffic Generating Developments* provides some guidance on mid-block capacities for urban roads with a LoS C deemed as satisfactory. This table is reproduced below.

Table 4.3
Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Source: - RTA's *Guide to Traffic Generating Developments* (2002)

Based on this table, noting that the New England Highway is a two lane two way road with parking lanes and Station Lane is a narrow two way two way road which would be expected in the future to accommodate some on-street car parking, it is considered that the New England Highway would have a two-way mid- block capacity of up to 1,800 vtp (2 x 900) and Station Lane would have a two way mid-block capacity of 1,200 vtp (2 x 600). However, as a sub-arterial road the New England Highway would be expected to operate satisfactorily with a LoS D which would equate to single lane capacities of 1,100 vtp or a two-way mid-block capacity of 2,200 vtp. Therefore, the road capacities adopted in this assessment as shown below in **Table 2**.

Table 2 - Adopted Mid-Block Road Capacities

Two Way Mid-Block Road Capacity (vtp)	
New England Highway	2,200
Station Lane	1,200

From the traffic volume data collected by Intersect Traffic the existing traffic volumes on the local and state road network are less than the determined road capacities (**Table 1**) therefore, existing spare capacity within the local and state road network is available to cater for additional traffic generated by development in the area.

7.0 ALTERNATE TRANSPORT MODES

There are no existing bus stops within 400 metres of the proposed development. An existing bus service, operated by Hunter Valley Buses, uses the New England Highway to connect Maitland to Branxton, North Rothbury & Singleton - Routes 179, 180 & 180X (see **Figures 2 and 3** below).

This service provides a frequent public transport service to all major retail, commercial and medical facilities in both the Maitland and Singleton CBD's as well as connecting to the City Rail train service at Maitland Station. This provides connection to Newcastle, the Central Coast and Sydney via the regular City Rail services. The nearest bus stops are located on the New England Highway to the west of Station lane (1.7 km) and on the New England Highway to the east of Station Lane (1.4 km) from the site; see **Photographs 7 & 8** showing the existing bus stops to the west of Station Lane.

As currently generally a rural area there are no existing bicycle and/or pedestrian pathways near the site to facilitate safe passage for pedestrian and cyclists around and adjacent to the site. Pedestrians and cyclists in the area are generally required to use the existing grass verges or share the travel lanes / shoulders on the local road network.

Photograph 10 below shows Lochinvar Railway Station which is approximately 250 metres south of the development site at the Station Lane / Old North Road intersection. This provides access to the Hunter rail line providing regular services between Newcastle and Scone allowing connection to Sydney trains and the North Coast rail line.

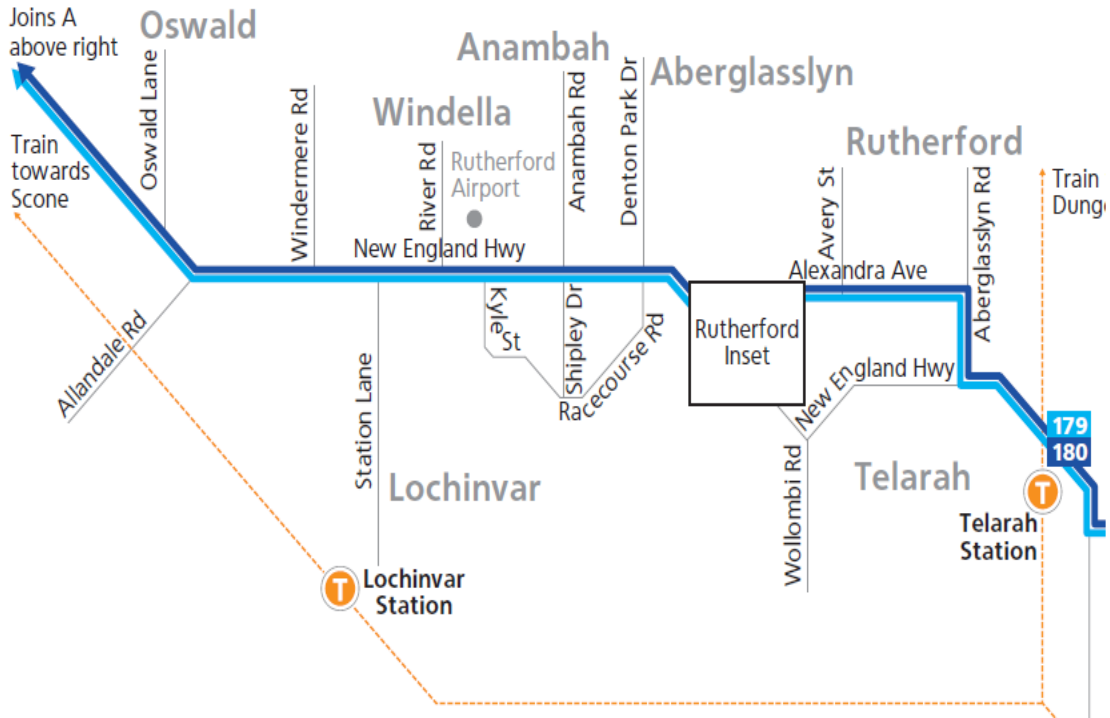


Figure 2 – Existing Bus Routes 179 & 180 - Hunter Valley Buses

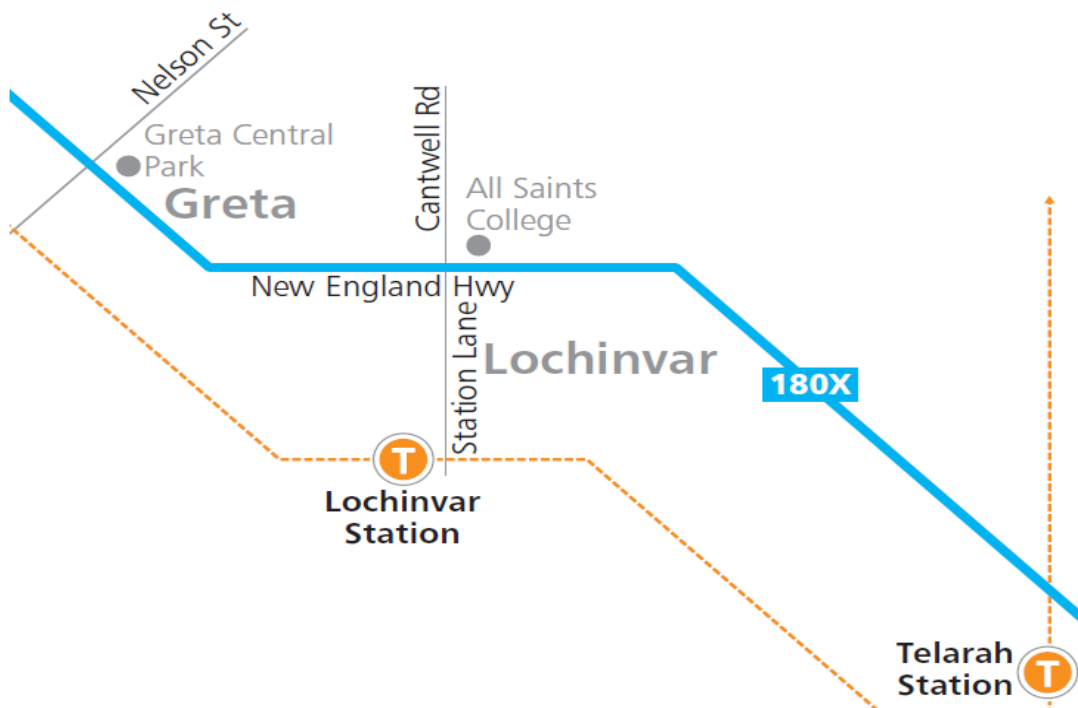


Figure 3 – Existing Bus Routes 180X - Hunter Valley Buses



Photograph 7 – Existing Bus Stop New England Highway southbound



Photograph 8 – Existing Bus Stop New England Highway northbound



Photograph 9 – Lochinvar Train Station

8.0 DEVELOPMENT PROPOSAL

The proposed development involves the subdivision of Lot 1308 in DP 1141533, 213 Station Lane, Lochinvar yielding up to 169 residential allotments, including retaining the existing residential house on the property. The subject site is within the Lochinvar Urban Release Area and currently contains a single rural property containing one dwelling and rural sheds. Access to the New England Highway to the north and rural areas to the south will be available via Station Lane.

Development of the Lochinvar Downs residential estate to the north of the site requires that the New England Highway / Station Lane intersection be upgraded to a left in, left out right in intersection initially and then to a left in and left out only intersection later both with a U-turn bay on the New England Highway to the west of Station Lane to allow eastbound vehicles to undertake a safe U-turn movement. This ultimate treatment is in accordance with the Lochinvar Structure Plan which proposes the New England Highway / Station Lane intersection be a left in and left out (LILO) intersection.

Connection to Station Lane will be via two new subdivision roads approximately 460 metres and 660 metres north-east of the Station Lane rail overbridge. No further residential development will be possible south of the site however an access for rail maintenance operation is provided through the development. The subdivision is designed in accordance with the approved Lochinvar URA masterplan and structure plan such that it will allow for further subdivisions to the north and east of the site as shown on the subdivision plan in **Attachment A**.

This report is required to support a development application to Maitland City Council for the subdivision and allow Council to assess the traffic impacts of this development and other known developments in the area.

9.0 TRAFFIC GENERATION

The RTA's *Guide to Traffic Generating Development's* and Technical Direction (TDT 2013/4) provide specific advice on the traffic generation potential of various land uses. Regarding low density residential dwellings, the following amended advice is provided within the Technical Direction.

Rates

Daily vehicle trips = 10.7 per dwelling in Sydney, 7.4 per dwelling in regional areas

Weekday average evening peak hour vehicle trips = 0.99 per dwelling in Sydney (maximum 1.39), 0.78 per dwelling in regional areas (maximum 0.90).

Weekday average morning peak hour vehicle trips = 0.95 per dwelling in Sydney (maximum 1.32), 0.71 per dwelling in regional areas (maximum 0.85).

*(The above rates do **not** include trips made internal to the subdivision, which may add up to an additional 25 %).*

Therefore, the additional traffic generated by the proposed residential lots, noting the existing dwelling is to remain on one of the new allotments during the weekday peak period can be calculated using the maximum rate values as follows (rounded up):

Daily vehicle trips = 169 dwellings x 7.4 trips per dwelling
= **1,251 vtpd.**

Weekday AM peak hour = 169 dwellings x 0.85 trips per dwelling
= **144 vtpd.**

Weekday PM peak hour = 169 dwellings x 0.9 trips per dwelling
= **153 vtpd.**

10.0 TRIP DISTRIBUTION

Before carrying out any traffic assessment the additional peak hour traffic generated by the development needs to be distributed through the adjoining road network. This involves making several assumptions as to distribution patterns to and from the development. In distributing the peak hour traffic through the adjacent road network, the following assumptions have been made for this development.

- ◆ Traffic from the residential subdivision will be distributed as 80% outbound and 20% inbound in the AM peak and 80% inbound and 20% outbound in the PM peak.
- ◆ Origin / destinations for traffic accessing the development will be split 50:40:10 from and to the east (Maitland), west (Branxton) and south (Kurri Kurri via Old North Road) respectively.
- ◆ It is assumed that the New England Highway / Wyndella Road signalised intersection is not connected to Station Lane prior to issue of the Subdivision Certificate for the development and the New England Highway / Station Lane intersection has been upgraded such that the right turn out movement from Station Lane is prohibited and the U-turn bay on the New England Highway for eastbound vehicles has been constructed. This is considered to be the most likely scenario upon release of the Subdivision Certificate for the development.
- ◆ Background traffic growth in the area has been assumed as 3% per annum on the basis that the Lochinvar URA will have a higher than normal development rate.

The resulting trip distribution for the subdivision is as shown in **Figure 4** below.

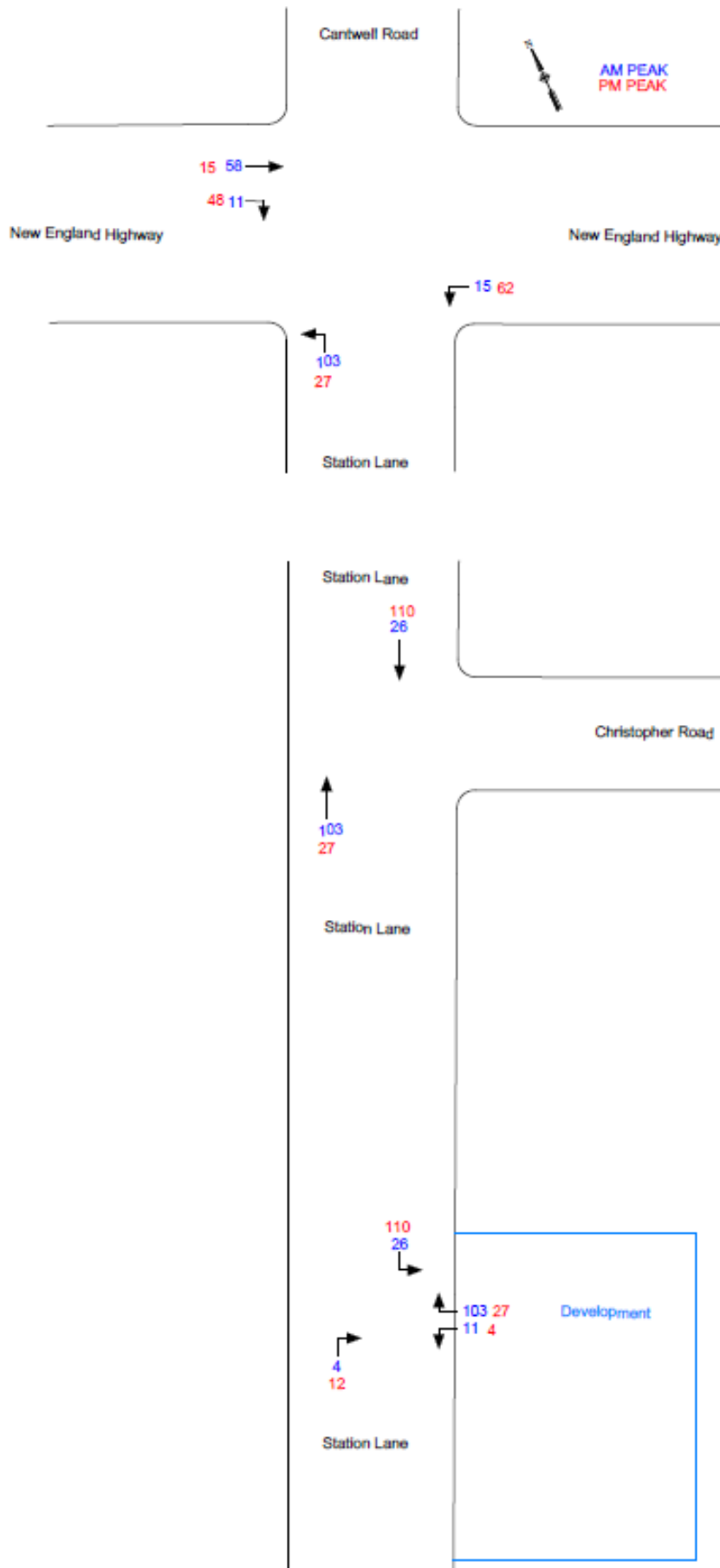


Figure 4 – Development Traffic Trip Distribution

11.0 CUMULATIVE TRAFFIC

The cumulative traffic impacts of other known developments in the area need to be considered in this assessment. A major known development in the area that has been approved with construction being undertaken on the Lochinvar Downs Estate. This provides for approximately 390 lots south of Christopher Road and east of Station Lane. The traffic generated by this development will be (314 vtpm in the AM peak and 332 vtpm in the PM peak (Intersect Traffic TIA (February 2018)). Similarly, a smaller known development in the area that is proposed is the 20 lot residential subdivision at 137 Station Lane, Lochinvar which provides for approximately 17 vtpm in the AM peak and 18 vtpm in the PM peak (Intersect Traffic TIA 20_128 (October 2020)). These are likely to use the New England Highway / Wyndella Road signals for access to the sub-arterial road network. Based on the trip distribution assumptions made in Section 10 the likely trip distribution from the Lochinvar Downs and 137 Station Lane subdivisions are as shown in **Figure 5** below.

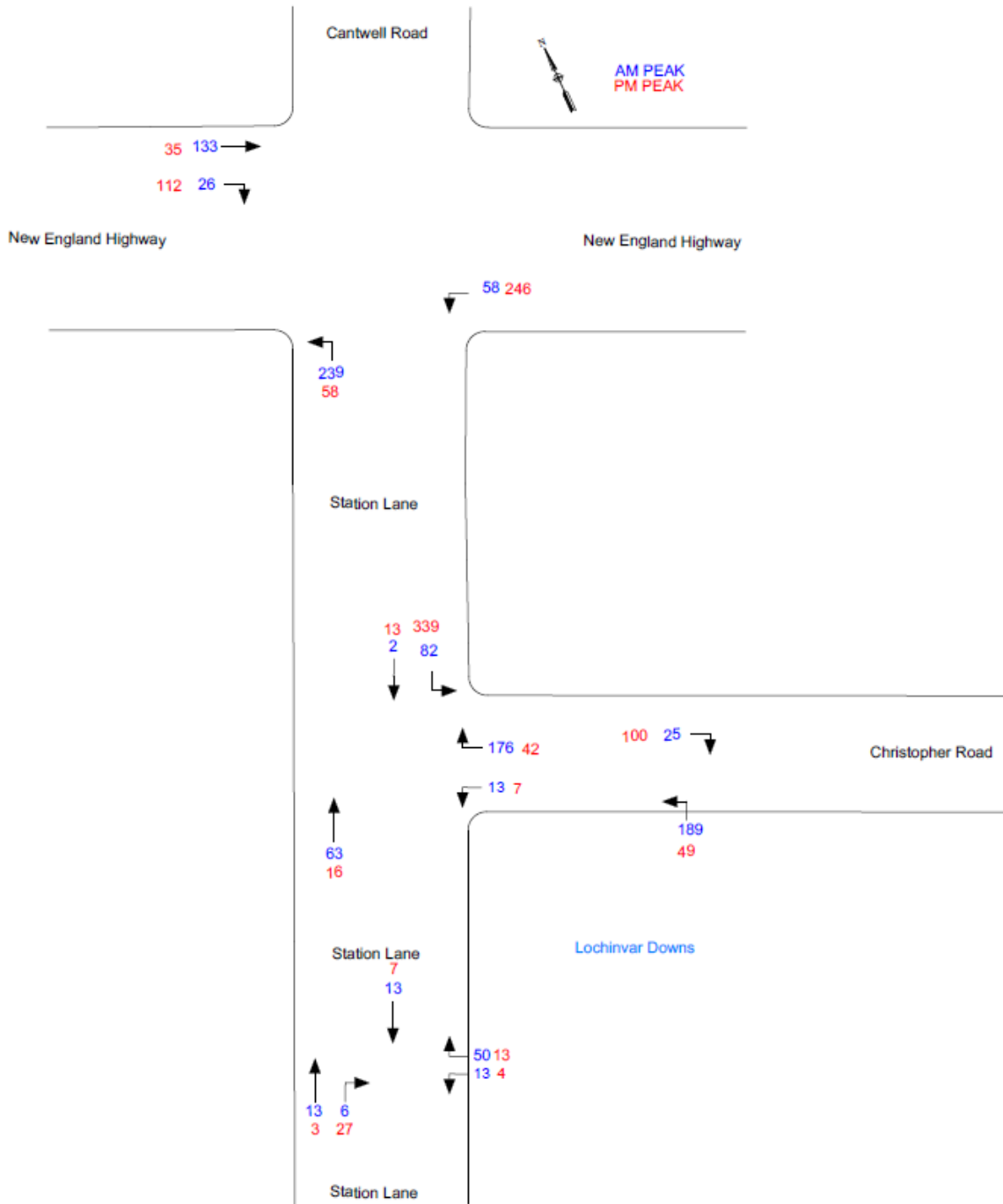


Figure 5 – Cumulative Development Traffic Trip Distribution

12.0 TRAFFIC IMPACTS OF DEVELOPMENT

The traffic impacts that the development will have on the local road network include:

- ◆ The impact of the additional traffic generated by the development on the capacity of the road network,
- ◆ The road safety issues associated with the proposed vehicular access to the development, and
- ◆ Impact of additional demand for alternate transport modes.

12.1 Road Network Capacity

It has previously been shown in **Section 6** of this report that the local road network is currently operating well within its technical mid-block capacity. The proposed subdivision as well as the Lochinvar Downs and 137 Station Lane developments will not adversely impact on the mid-block capacity of the New England Highway or Station Lane as post development the two way mid-block traffic volumes on the local and state road network will remain below the capacity thresholds for these roads through to at least 2031. This is demonstrated in **Table 3** below.

Table 3 – Two-way Mid-Block Road Capacity assessment

Road	Section	Capacity vtph	2021		2031 @ 3% p.a.		Dev'mnt traffic		Other Dev'mnts	
			AM (vtph)	PM (vtph)	AM (vtph)	PM (vtph)	AM	PM	AM	PM
New England Highway	East of Station Lane	2200	1522	1670	1955	2121	73	77	191	281
New England Highway	West of Station Lane	2200	1836	1621	2271	2077	172	90	398	205
Station Lane	South of New England Highway	1200	723	730	816	791	129	137	323	416

This is consistent with the findings of the Lochinvar Traffic Study (URaP-TTW 2012) which assessed the traffic impacts of the full Lochinvar Urban Release Area. Similarly, with all internal roads being constructed to the requirements of the Structure Plan and URaP Traffic Study (2012) the internal road network will also have sufficient capacity to cater for this development.

Overall, it can be concluded that the existing local and state road network, subject to suitable intersection controls being in place, has sufficient spare two-way mid-block capacity to cater for the proposed development.

12.2 Intersection Capacity

The impacts of the development on the New England Highway / Station Lane / Cantwell Road give way priority controlled cross intersection are best assessed using the SIDRA INTERSECTION modelling software based on the level of service requirements of TfNSW shown below in Table 4.2.

This software package predicts likely delays, queue lengths and thus levels of service that will occur at intersections.

Assumptions made in this modelling were:

- ◆ The intersection layout will remain as per current condition.
- ◆ Traffic volumes used in the modelling were as collected by Intersect Traffic in June 2016.
- ◆ Additional traffic generated by the development is distributed as per **Figures 4 & 5**.
- ◆ Future traffic volumes are predicted using a 3.0% per annum background traffic growth rate due to the future development in the Lochinvar Local Urban Release Area. However as the cumulative developments accounted for in this assessment are likely to be the major traffic

growth for the left turn movement out of Station Lane, right turn movement into Station Lane and left turn movement into Station Lane use of a 3 % pa traffic growth rate would over estimate the future traffic volumes for those movements so a 1.5 % pa background traffic growth rate (which is the average background traffic growth in the Lower Hunter area) has been adopted just for these movements.

- ◆ The minimum gap acceptance values recommended by Austroads have been used in this modelling.

Table 4.2
Level of service criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode

Source: - RTA's Guide to Traffic Generating Developments (2002).

The summarised 'all vehicles' results of the modelling for the intersection are provided in **Table 3** below with the worst movement level of service provided. Note Cantwell Road movements are ignored in this table as they are minor. The Sidra Movement Summary Tables are provided in **Appendix 3**.

Table 3 – New England Highway / Station Lane / Cantwell Road cross intersection – Sidra Results Summary

Modelled Peak	Degree of Saturation (v/c)	Worst Average Delay (s)	Worst Level of Service	95% back of queue length (cars)
2021 AM	0.445	13.1	A	0.9
2021 PM	0.372	10.3	A	0.7
2021 AM + all known developments	0.685	20.1	A	6.1
2021 PM + all known developments	0.555	19.3	B	2.9
2031 AM + all known developments	1.015	73.1	F	29.6
2031 PM + all known developments	0.756	31.1	C	4.8

The summarised results of the modelling in **Table 3** show that the modified intersection will operate satisfactorily with traffic from this and other known developments on it post development as all major movements have average delays and LoS within the acceptable criteria set by TfNSW. However by 2031 the left turn movement onto the New England Highway from Station Lane during the AM peak become saturated with queuing occurring and starting to reach unacceptable levels.

Therefore the road connection from Station Lane to the New England Highway / Wyndella Road traffic signals along Christopher Road and the western collector road with connection to the New England Highway near St Helena Close will both need to be established prior to 2031 to reduce the use of the U-turn bay on the New England Highway from traffic coming off Station Lane.

On the basis of the above results and noting the road connection from Station Lane to the New England Highway / Wyndella Road traffic signals will be available prior to the release of any lots within this subdivision there is no need to condition any consent issued with this development with a requirement to have the connection available before release of a subdivision certificate for this development.

Traffic from this subdivision is highly unlikely to divert to the New England Highway / Robert Road intersection as modelling undertaken by Intersect Traffic for the Lochinvar Downs development shows this intersection will also be operating with long delays by 2031 also. Therefore it is considered there is no need to model the New England Highway / Robert Road intersection in this assessment.

Given the New England Highway / Wyndella Road traffic signals are already constructed and both the Hereford Park and Lochinvar Downs subdivisions are under construction it is reasonable to conclude the link from Station Lane to Wyndella Road will be open within 1 to 2 years and thus the New England Highway / Station Lane left turn out movement will continue to operate satisfactorily beyond 2031. These results are consistent with the findings of the Traffic Report prepared for the Lochinvar URA.

As the New England Highway / Wyndella Road traffic signals have been designed to cater for the full development of the Lochinvar URA, which will be accessed by development traffic via the Christopher Road improvements when completed, it is reasonable to conclude that there is no need for further intersection analysis and the new subdivision will not adversely impact on the safety and efficiency of the local and state road network.

12.3 Subdivision Road Network

Having reviewed the current Lochinvar Structure Plan, it is considered the proposed subdivision layout and road network proposed is consistent with the indicative road layout. Road reserve widths and carriageway requirements will need to be in accordance with Maitland City Council’s Manual of Engineering Standards and would be expected to be conditioned in any consent issued for the subdivision.

12.4 Vehicular Access

The external road connections to the existing road network at Station Lane are appropriately located with the available safe intersection sight distances being more than Austroads requirements for 50 km/h speed zone of 100 metres though confirmation at Construction Certificate stage will be required. Traffic volumes at these two intersections will be less than the thresholds given for uninterrupted flow conditions within the following table sourced from Austroads *Guide to Traffic Management – Part 6 – Intersections, Interchanges and Crossings (2009)* for which the Guide states a detailed analysis to demonstrate that adequate capacity is available is unlikely to be required.

Major road type ¹	Major road flow (vph) ²	Minor road flow (vph) ³
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

It can therefore be concluded that the proposed external road connection intersections on Station Lane for the subdivision can be constructed as normal basic right turn and basic left turn (BAR/BAL) urban intersections.

Overall, it is considered that the proposed access arrangements and internal road network for the development are suitable for the type of development and the road environment and expected traffic volumes within the subdivision. It is also consistent with the Lochinvar URA Structure Plan as shown on the subdivision plan provided in **Attachment A**.

12.5 Off-Street Car Parking

As a residential subdivision, the development itself does not generate any on-site parking demand. However, future development of each of the allotments will generate a parking demand and on-site car parking will need to be further assessed at the development application stage for the individual allotments.

Maitland City Council's DCP requires the provision of a minimum of 1 space per residential dwelling. Given that the residential lot sizes of the new allotments will meet the minimum DCP requirements it is considered they are more than large enough to accommodate a large dwelling incorporating at least 1 on-site car parking space.

It can be concluded that future development of the new residential allotments would be easily able to accommodate the required on-site car parking under Maitland City Council's DCP and the development will not generate an unacceptable on-street car parking demand that would adversely impact on the local road network.



13.0 PEDESTRIAN & CYCLE FACILITIES

As a residential subdivision, the proposal is likely to generate additional pedestrian and bicycle traffic. Provision of pedestrian pathways / cycleways within the subdivision would provide some benefit to pedestrians / cyclists and will need to be provided in accordance with Maitland City Council's subdivision standards.

Externally there will need to be pedestrian pathways / cycleways within the LURA and it is thought that with much of the public transport access on the New England Highway a pedestrian / cycleway path along the site frontage in Station Lane would provide benefit to future residents of the residential area. However, these pathways are included within the S94 Contributions Plan for the LURA as well as within the road requirements of the DCP and Council could defer the construction of these facilities until the demand warrants the construction of the facilities or condition them within any development consent. If they are required as part of the subdivision works, they would then be eligible for developer contribution off-sets.

14.0 PUBLIC TRANSPORT FACILITIES

The proposed development may generate some additional public transport usage particularly regarding school bus services. The scale of this development is such that it would not be enough to warrant changes to the existing school bus services. However it is likely that Station Lane will be a future bus route to cater for demand from the full Lochinvar URA and the road width for construction of Station Lane should include for Station Lane as a bus route and a suitable condition of consent included in any consent issued for the development.

Therefore, in terms of constructed road widths the development should be suitably conditioned in line with the recommended road hierarchy within the Lochinvar Structure Plan. This is likely to be reflected in the road upgrading works required by Maitland City Council and within the developer contributions to be paid as a condition of this development.

Payment of the developer contributions for this development would be a satisfactory contribution to future additional public transport infrastructure resulting from any increased demand generated by this subdivision.



15.0 CONCLUSIONS

This traffic impact assessment for the proposed residential subdivision of Lot 1308 in DP 1141533, 213 Station Lane, Lochinvar providing for 169 residential allotments has concluded:

- ◆ Existing traffic volumes on the local and state road network are within the technical two-way mid-block capacity standards for urban roads determined by Austroads and TfNSW,
- ◆ The full development of the site is likely to generate an additional 144 vph in the AM peak and 153 vph in the PM peak,
- ◆ The local and state road network, subject to suitable intersection controls being in place, has sufficient spare two-way mid-block capacity to cater for the proposed development.
- ◆ Given the New England Highway / Wyndella Road traffic signals have been designed to cater for the full development of the Lochinvar URA and the development does not adversely impact on the New England Highway / Station Lane through to 2031 it is concluded that the development does not adversely impact on the effectiveness and efficiency of the local and state road network as a road connection from Station Lane to the new signalised intersection will be available within 2 years.
- ◆ As the road connection from Station Lane to the New England Highway / Wyndella Road traffic signals will be available prior to the release of any lots within this subdivision there is no need to condition any consent issued with this development with a requirement to have the connection available before release of a subdivision certificate for this development.
- ◆ The proposed subdivision layout and road network proposed is consistent with the indicative road layout within the Lochinvar Structure Plan. Road reserve widths and carriageway requirements will need to be in accordance with Maitland City Council's Manual of Engineering Standards and would be expected to be conditioned in any consent issued for the subdivision.
- ◆ As a residential subdivision, the proposal is likely to generate additional pedestrian and bicycle traffic. Provision of pedestrian pathways / cycleways within the Station Lane frontage would provide some benefit to pedestrians / cyclists and will need to be provided in accordance with Maitland City Council's subdivision standards.
- ◆ External pathways are included within the Developer Contributions Plan for the LURA as well as within the road requirements of the DCP and Council could defer the construction of these facilities until the demand warrants the construction of the facilities or condition them within any development consent. If they are required as part of the subdivision works, they would then be eligible for developer contribution off-sets.
- ◆ The proposed development may generate some additional public transport usage particularly regarding school bus services. The scale of the development is such that when fully developed the additional demand may be enough to require changes to the existing school bus services. Therefore, in terms of constructed road widths the development should cater for Station Lane being a future bus route.

16.0 RECOMMENDATION

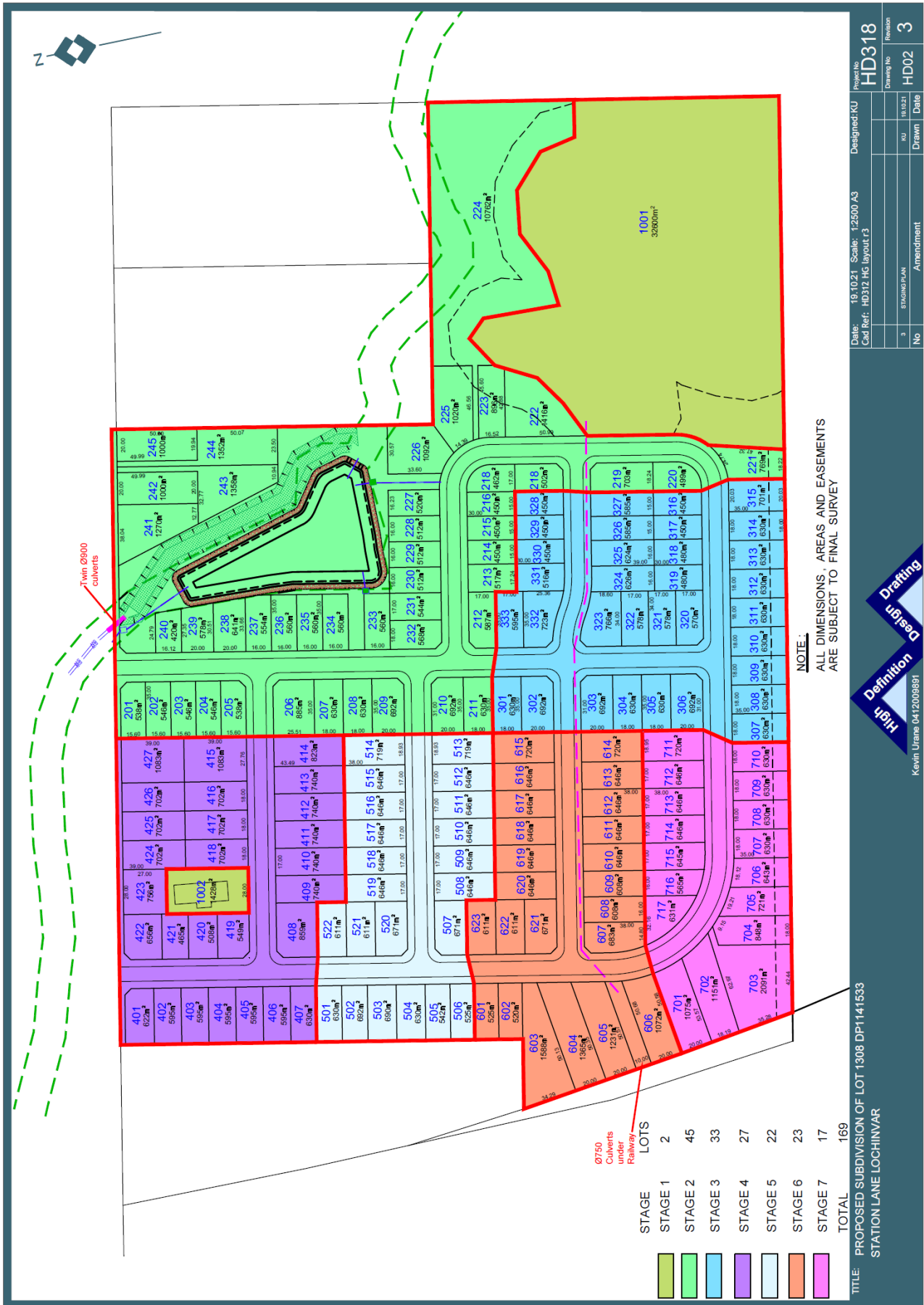
Having carried out this traffic impact assessment it is recommended that the proposed residential subdivision of Lot 1308 in DP 1141533, 213 Station Lane, Lochinvar providing for 221 residential allotments be supported as the development will not adversely impact on the local and state road network and complies with all relevant Maitland City Council, Austroads and Transport for NSW (TfNSW) requirements.



JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

ATTACHMENT A

Development Plans



ATTACHMENT B

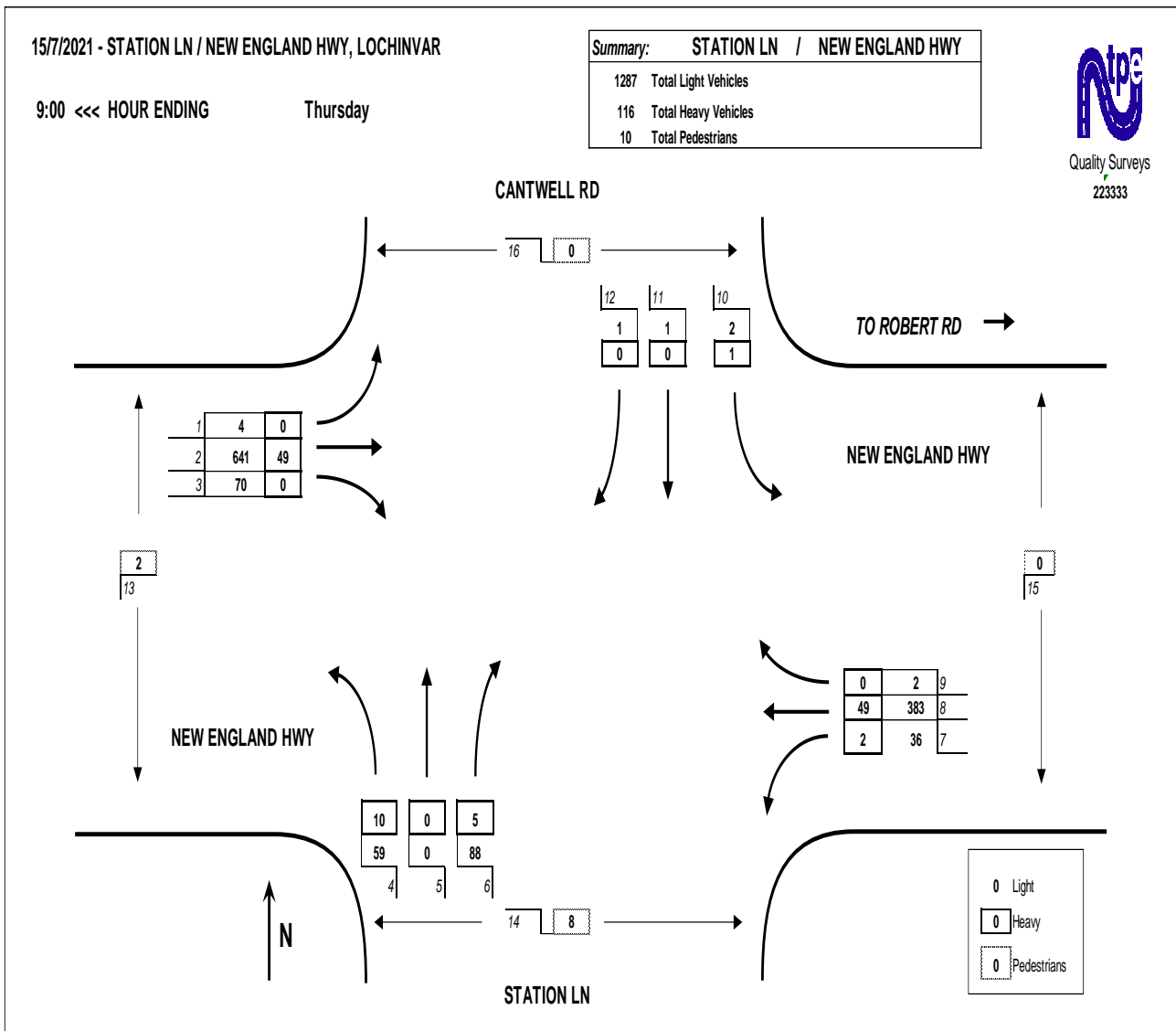
Traffic Count Data

15/7/2021 - STATION LN / NEW ENGLAND HWY, LOCHINVAR

9:00 <<< HOUR ENDING

Thursday

Summary:	STATION LN / NEW ENGLAND HWY
1287	Total Light Vehicles
116	Total Heavy Vehicles
10	Total Pedestrians

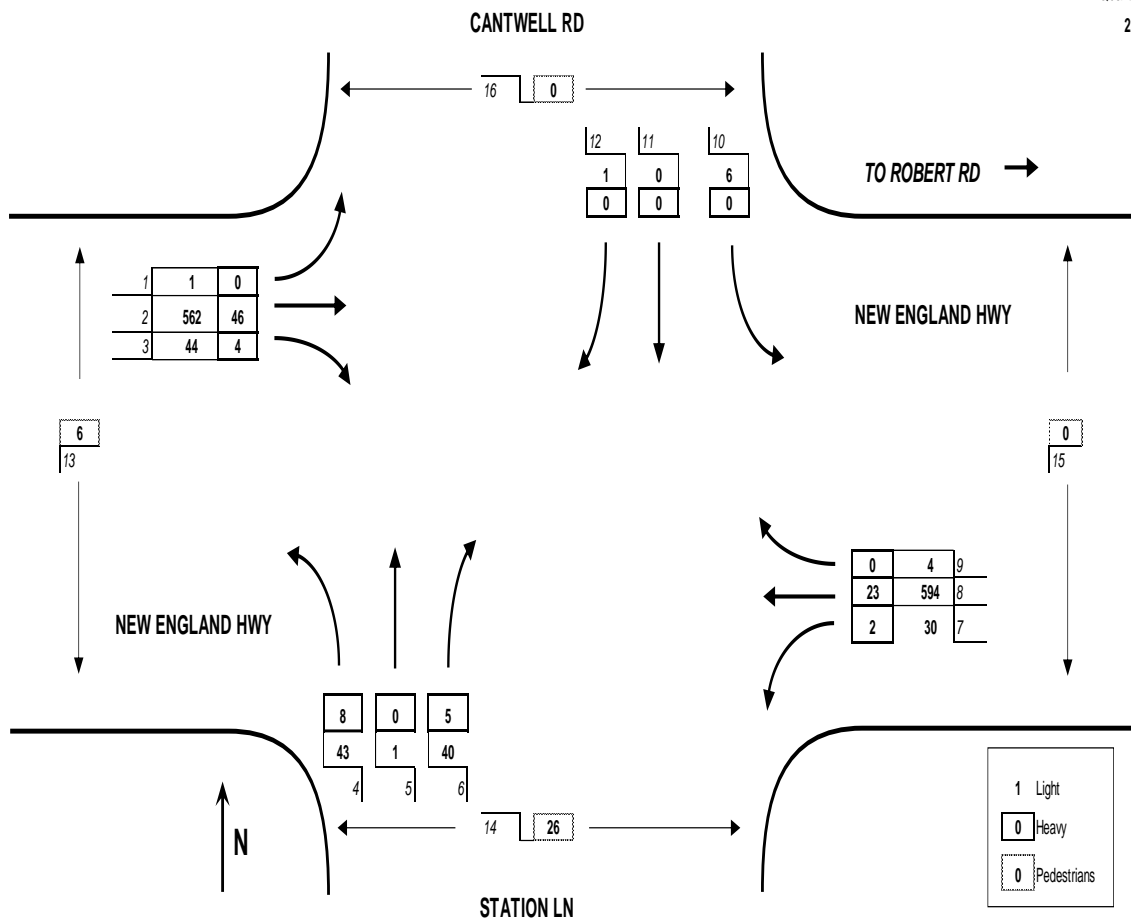


14/7/2021 - STATION LN / NEW ENGLAND HWY, LOCHINVAR

16:00 <<< HOUR ENDING

Wednesday

Summary:	STATION LN / NEW ENGLAND HWY
1326	Total Light Vehicles
88	Total Heavy Vehicles
32	Total Pedestrians



ATTACHMENT C

Sidra Summary Results

MOVEMENT SUMMARY

Site: 101 [2021AM (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection

213 Station Lane Residential Development

Site Category: (None)

Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	162	15	171	9.3	0.231	7.8	LOS A	0.9	6.6	0.53	0.76	0.53	43.2
Approach		162	15	171	9.3	0.231	7.8	LOS A	0.9	6.6	0.53	0.76	0.53	43.2
East: New England Highway														
4	L2	38	2	40	5.3	0.022	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.4
5	T1	432	49	455	11.3	0.250	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	2	0	2	0.0	0.005	11.6	LOS A	0.0	0.1	0.68	0.72	0.68	45.9
Approach		472	51	497	10.8	0.250	0.6	NA	0.0	0.1	0.00	0.05	0.00	59.0
North: Cantwell Road														
7	L2	5	1	5	20.0	0.015	13.1	LOS A	0.0	0.4	0.72	0.82	0.72	44.1
Approach		5	1	5	20.0	0.015	13.1	LOS A	0.0	0.4	0.72	0.82	0.72	44.1
West: New England Highway														
10	L2	4	0	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	783	54	824	6.9	0.445	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
12	R2	70	0	74	0.0	0.091	8.2	LOS A	0.3	2.4	0.51	0.73	0.51	43.9
Approach		857	54	902	6.3	0.445	0.8	NA	0.3	2.4	0.04	0.06	0.04	57.9
All Vehicles		1496	121	1575	8.1	0.445	1.5	NA	0.9	6.6	0.08	0.14	0.08	56.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [2021AM + cumulative development (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection
213 Station Lane Residential Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	504	15	531	3.0	0.685	11.7	LOSA	6.1	43.5	0.72	1.13	1.37	41.0
Approach		504	15	531	3.0	0.685	11.7	LOSA	6.1	43.5	0.72	1.13	1.37	41.0
East: New England Highway														
4	L2	111	2	117	1.8	0.064	5.6	LOSA	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	432	49	455	11.3	0.250	0.1	LOSA	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	2	0	2	0.0	0.007	16.1	LOS B	0.0	0.2	0.80	0.84	0.80	43.5
Approach		545	51	574	9.4	0.250	1.3	NA	0.0	0.2	0.00	0.12	0.00	57.9
North: Cantwell Road														
7	L2	5	1	5	20.0	0.026	20.1	LOS B	0.1	0.6	0.84	0.92	0.84	40.7
Approach		5	1	5	20.0	0.026	20.1	LOS B	0.1	0.6	0.84	0.92	0.84	40.7
West: New England Highway														
10	L2	4	0	4	0.0	0.002	5.5	LOSA	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	974	54	1025	5.5	0.548	0.1	LOSA	0.0	0.0	0.00	0.00	0.00	59.5
12	R2	107	0	113	0.0	0.152	8.9	LOSA	0.6	4.1	0.56	0.80	0.56	43.4
Approach		1085	54	1142	5.0	0.548	1.0	NA	0.6	4.1	0.06	0.08	0.06	57.4
All Vehicles		2139	121	2252	5.7	0.685	3.6	NA	6.1	43.5	0.20	0.34	0.35	52.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [2031AM + cumulative development (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection
 213 Station Lane Residential Development
 Site Category: (None)
 Give-Way (Two-Way)
 Design Life Analysis (Final Year): Results for 10 years

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	504	15	616	3.0	1.015	57.1	LOS E ¹¹	29.6	212.2	1.00	3.02	6.61	23.8
Approach		504	15	616	3.0	1.015	57.1	LOS E ¹¹	29.6	212.2	1.00	3.02	6.61	23.8
East: New England Highway														
4	L2	111	2	136	1.8	0.074	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	432	49	611	11.3	0.337	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	2	0	3	0.0	0.032	42.1	LOS C	0.1	0.6	0.94	0.98	0.94	33.2
Approach		545	51	750	9.6	0.337	1.3	NA	0.1	0.6	0.00	0.11	0.00	57.9
North: Cantwell Road														
7	L2	5	1	7	20.0	0.148	73.1	LOS F ¹¹	0.4	3.1	0.97	0.99	0.98	25.6
Approach		5	1	7	20.0	0.148	73.1	LOS F ¹¹	0.4	3.1	0.97	0.99	0.98	25.6
West: New England Highway														
10	L2	4	0	6	0.0	0.003	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	974	54	1378	5.5	0.737	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	58.8
12	R2	107	0	131	0.0	0.231	11.2	LOS A	0.9	6.3	0.67	0.88	0.71	41.8
Approach		1085	54	1514	5.0	0.737	1.2	NA	0.9	6.3	0.06	0.08	0.06	56.8
All Vehicles		2139	121	2887	5.8	1.015	13.3	NA	29.6	212.2	0.25	0.72	1.45	44.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

¹¹ Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.

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MOVEMENT SUMMARY

▽ Site: 101 [2021PM (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection
213 Station Lane Residential Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	97	13	102	13.4	0.190	9.9	LOS A	0.7	5.2	0.62	0.82	0.62	41.4
Approach		97	13	102	13.4	0.190	9.9	LOS A	0.7	5.2	0.62	0.82	0.62	41.4
East: New England Highway														
4	L2	32	2	34	6.3	0.019	5.6	LOS A	0.0	0.0	0.00	0.57	0.00	53.4
5	T1	618	23	651	3.7	0.342	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	4	0	4	0.0	0.007	9.8	LOS A	0.0	0.2	0.59	0.69	0.59	47.0
Approach		654	25	688	3.8	0.342	0.4	NA	0.0	0.2	0.00	0.03	0.00	59.2
North: Cantwell Road														
7	L2	7	0	7	0.0	0.013	9.0	LOS A	0.0	0.3	0.59	0.71	0.59	47.0
Approach		7	0	7	0.0	0.013	9.0	LOS A	0.0	0.3	0.59	0.71	0.59	47.0
West: New England Highway														
10	L2	2	0	2	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	653	51	687	7.8	0.372	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
12	R2	48	4	51	8.3	0.087	10.3	LOS A	0.3	2.3	0.60	0.83	0.60	42.3
Approach		703	55	740	7.8	0.372	0.8	NA	0.3	2.3	0.04	0.06	0.04	58.1
All Vehicles		1461	93	1538	6.4	0.372	1.3	NA	0.7	5.2	0.07	0.10	0.07	56.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [2021PM + development (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection
 213 Station Lane Residential Development
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	182	13	192	7.1	0.337	10.6	LOSA	1.4	10.7	0.66	0.89	0.82	41.4
Approach		182	13	192	7.1	0.337	10.6	LOSA	1.4	10.7	0.66	0.89	0.82	41.4
East: New England Highway														
4	L2	340	2	358	0.6	0.194	5.6	LOSA	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	618	23	651	3.7	0.342	0.1	LOSA	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	4	0	4	0.0	0.008	10.4	LOSA	0.0	0.2	0.63	0.72	0.63	46.6
Approach		962	25	1013	2.6	0.342	2.1	NA	0.0	0.2	0.00	0.21	0.00	56.8
North: Cantwell Road														
7	L2	7	0	7	0.0	0.015	9.6	LOSA	0.0	0.3	0.62	0.74	0.62	46.6
Approach		7	0	7	0.0	0.015	9.6	LOSA	0.0	0.3	0.62	0.74	0.62	46.6
West: New England Highway														
10	L2	2	0	2	0.0	0.001	5.5	LOSA	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	703	51	740	7.3	0.400	0.1	LOSA	0.0	0.0	0.00	0.00	0.00	59.7
12	R2	208	4	219	1.9	0.555	19.3	LOS B	2.9	20.3	0.85	1.08	1.37	36.8
Approach		913	55	961	6.0	0.555	4.5	NA	2.9	20.3	0.19	0.25	0.31	52.3
All Vehicles		2064	93	2173	4.5	0.555	3.9	NA	2.9	20.3	0.15	0.29	0.21	53.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [2031PM + development (Site Folder: General)]

New England Highway / Station Lane / Cantwell Road 4 way give way-controlled Cross Intersection
 213 Station Lane Residential Development
 Site Category: (None)
 Give-Way (Two-Way)
 Design Life Analysis (Final Year): Results for 10 years

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] veh/h	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Station Lane														
1	L2	182	13	222	7.1	0.608	19.3	LOS B	3.0	22.2	0.87	1.13	1.47	36.3
Approach		182	13	222	7.1	0.608	19.3	LOS B	3.0	22.2	0.87	1.13	1.47	36.3
East: New England Highway														
4	L2	340	2	415	0.6	0.225	5.6	LOSA	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	618	23	874	3.7	0.459	0.2	LOSA	0.0	0.0	0.00	0.00	0.00	59.7
6	R2	4	0	6	0.0	0.018	15.6	LOS B	0.1	0.4	0.79	0.90	0.79	43.7
Approach		962	25	1295	2.7	0.459	2.0	NA	0.1	0.4	0.00	0.19	0.00	56.9
North: Cantwell Road														
7	L2	7	0	10	0.0	0.034	15.2	LOS B	0.1	0.7	0.79	0.90	0.79	43.5
Approach		7	0	10	0.0	0.034	15.2	LOS B	0.1	0.7	0.79	0.90	0.79	43.5
West: New England Highway														
10	L2	2	0	3	0.0	0.002	5.5	LOSA	0.0	0.0	0.00	0.58	0.00	51.3
11	T1	703	51	994	7.3	0.538	0.1	LOSA	0.0	0.0	0.00	0.00	0.00	59.5
12	R2	208	4	254	1.9	0.756	31.1	LOS C	4.8	34.0	0.95	1.27	2.05	31.5
Approach		913	55	1251	6.2	0.756	6.4	NA	4.8	34.0	0.19	0.26	0.42	50.4
All Vehicles		2064	93	2779	4.6	0.756	5.4	NA	4.8	34.0	0.16	0.30	0.31	51.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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